

CLAIMS

What is claimed is:

1. A microvalve for controlling the operation of a first valve comprising:
 - a plurality of layers defining a body, the body having a chamber and a plurality of ports in fluid communication with the chamber;
 - a movable portion positioned within the chamber, the movable portion being selectively moved to control a fluid flow in a first fluid circuit;
 - wherein the first valve is moved to a first position when there is a fluid flow from a first fluid source through the chamber, and the first valve is moved to a second position when there is a fluid flow from the first valve through the chamber to a first fluid reservoir.
2. The microvalve defined in Claim 1 wherein the first fluid circuit comprises the first fluid source and the first fluid reservoir;
 - wherein the movable portion is selectively movable to one of:
 - allow the fluid flow from the first fluid source through the chamber to actuate the first valve; and
 - allow the first fluid flow from the first valve to the first fluid reservoir to de-actuate the first valve.
3. The microvalve defined in Claim 1 wherein the fluid flow from the chamber to the first valve actuates the first valve, and the fluid flow from the first valve to the chamber de-actuates the first valve.
4. The microvalve defined in Claim 3 further comprising a second fluid circuit having a load and a second fluid reservoir.

5. The microvalve defined in Claim 4 wherein actuation of the first valve by the microvalve allows fluid flow from a second source through the first valve to the load.

6. The microvalve defined in Claim 5 wherein de-actuation of the first valve by the microvalve allows fluid flow from the load through the first valve to the second fluid reservoir.

7. A microvalve device comprising:

a microvalve pilot valve including a first layer, a third layer having a plurality of openings formed therethrough, and a second layer being positioned between the first layer and the third layer, the second layer including a chamber in fluid communication with the openings, and a movable member for selectively controlling fluid flow through the chamber and between the openings; and

a pilot operated valve including a first plate, a third plate, and a second plate positioned between the first plate and the third plate;

wherein the first plate includes a plurality of ports in fluid communication with the openings of the microvalve, a pressure apply channel, and a pressure release channel;

the second plate includes the pressure apply channel and the pressure release channel, both of the channels being in fluid communication with a spool portion of the pilot operated valve, the spool portion being selectively movable to allow flow from a second source of fluid to a load;

the third plate includes:

a first source port in fluid communication with a first fluid source, the pressure apply channel, one of the first plate ports, and one of the microvalve openings;

a first reservoir port in fluid communication with a first reservoir, the pressure release channel, one of the first plate ports, and one of the microvalve openings;

a second source port in fluid communication with the second source of fluid; and

a load port in fluid communication with the load.

8. The microvalve device defined in Claim 7 wherein the pilot operated valve is a macro-sized valve.

9. The microvalve device defined in Claim 7 wherein the pilot operated valve is a plate valve.

10. The microvalve device defined in Claim 8 wherein the pilot operated valve is a plate valve.

11. The microvalve device defined in Claim 7 wherein the pilot operated valve is a spool valve.

12. The microvalve device defined in Claim 8 wherein the pilot operated valve is a spool valve.

13. The microvalve device defined in Claim 12 wherein the spool valve includes a spool that is positioned within a cutout portion of the second plate, and is configured for axial movement within the cutout portion.

14. The microvalve defined in Claim 13 wherein the spool comprises a first opening and a second opening formed therethrough such that the spool valve is actuated when the first opening is over the load port and source port and the second opening is blocked, and the spool valve is de-actuated when the first opening is over the load port and the second opening is over a second reservoir port and the spool blocks the supply port.

15. A plate valve comprising:
a first plate defining a plurality of ports connected with a second plate;
a second plate defining a chamber, the chamber having a spool positioned therein the spool being movable between a first position and a second position; and a plurality of fluid channels, the fluid channels being in fluid communication with the plurality of ports; and
a third plate including a first port connected with a first source of fluid, a second port connected with a reservoir; a third port connected with a second source of fluid; and a fourth port connected with a load; wherein one of the fluid channels connects the first source of fluid with one of the plurality of openings of the first plate and the spool, another of the fluid channels connects the reservoir with one of the openings of the first plate and the spool;
wherein movement of the spool is caused by at least one of fluid moving from the first source of fluid to the spool, and from the spool to the reservoir;
and
movement of the spool creates a fluid path between the second source of fluid and the load.

16. The plate valve defined in Claim 15 wherein the valve is macro-sized.

17. The plate valve defined in Claim 16 wherein the plurality of openings of the first plate are in fluid communication with a microvalve, the plate valve acting as a pilot valve for the plate valve.
18. The plate valve defined in Claim 15 wherein the spool is a round spool.
19. The plate valve defined in Claim 18 further comprising a diaphragm, the diaphragm being positioned at one end of the spool.
20. The plate valve defined in Claim 19 wherein the fluid is one of a hydraulic fluid and air.